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ORIGINAL ARTICLE

Comparison of extracorporeal shock wave lithotripsy running models between outsourcing cooperation and rental cooperation conducted in Taiwan

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Background/Purpose: We conducted a retrospective study to compare the cost and effectiveness between two different running models for extracorporeal shock wave lithotripsy (SWL), including the outsourcing cooperation model (OC) and the rental cooperation model (RC).
Methods: Between January 1999 and December 2005, we implemented OC for the SWL, and from January 2006 to October 2011, RC was utilized. With OC, the cooperative company provided a machine and shared a variable payment with the hospital, according to treatment sessions. With RC, the cooperative company provided a machine and received a fixed rent from the hospital. We calculated the cost of each treatment session, and evaluated the break-even point to estimate the lowest number of treatment sessions to make the balance between revenue and cost every month. Effectiveness parameters, including the stone-free rate, the retreatment rate, the rate of additional procedures and complications, were evaluated.
Results: Compared with OC there were significantly less treatment sessions for RC every month (42.6 ± 7.8 vs. 36.8 ± 6.5, $p = 0.01$). The cost of each treatment session was significantly higher for OC than for RC (751.6 ± 20.0 USD vs. 684.7 ± 16.7 USD, $p = 0.01$). The break-even point for the hospital was 27.5 treatment sessions/month for OC, when the hospital obtained 40% of

Conflicts of interest: The authors have no conflicts of interest relevant to this article.

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the payment, and it could be reduced if the hospital got a greater percentage. The break-even point for the hospital was 27.3 treatment sessions/month for RC. No significant differences were noticed for the stone-free rate, the retreatment rate, the rate of additional procedures and complications.

Conclusion: Our study revealed that RC had a lower cost for every treatment session, and fewer treatment sessions of SWL/month than OC. The study might provide a managerial implication for healthcare organization managers, when they face a situation of high price equipment investment.

Introduction

Extracorporeal shock wave lithotripsy (SWL) has been a treatment of revolution for the management of urolithiasis. SWL is an alternative and preferred modality for the treatment of renal and ureteral stones.[1] In 1997 and 2007, the American Urological Association Ureteral Stones Clinical Guidelines Panel suggested that either ureteroscopic lithotripsy (URSL) or SWL was considered a minimally invasive and acceptable treatment option for distal ureteral stones $<$1 cm. The professional recommendations for treatment were based on success, retreatment and complication rates, and less on the cost of treatment or patient preference.[2]

In 2001, the cost of treating urolithiasis was $>$20 billion US dollars in the US.[3] Lotan and Pearle suggested that for ureteral stones, observation was the least costly treatment modality and URSL was less costly than SWL.[4] The SWL machine (HM3, Dornier Medtech, Kennesaw, Georgia) was introduced into Taiwan in 1985 for the treatment of patients, with great success. Therefore, many hospitals tried to purchase this high price SWL machine and increase their own competitive advantages. Most hospitals in Taiwan purchased the SWL machine (i.e., a self-support model) initially. For budget limitation, some hospitals tried outsourcing cooperation (OC) or rental cooperation (RC) to equip the machine from the cooperative company instead of purchasing it later. The payment of SWL reimbursement from the Bureau of Health Insurance (BNHI) was regulated as a case payment in 1995, and the reimbursement for each treatment session was fixed. The total number of treatment sessions of SWL has increased rapidly in the last decade; the BNHI implemented some rules (such as patients with a staghorn or partial staghorn stone, a renal stone size $>$ 2.5 cm or a ureteral stone $>$1.5 cm were excluded for SWL) to limit the growing expense from SWL.

In daily practice, the cost derived from SWL has become a very important impact factor in choosing the best therapeutic strategy for patients with urolithiasis. Cost-effectiveness analysis is a useful tool for comparing different treatment or running modalities, especially if the cost and effectiveness vary significantly among the modalities.[5] Our objective is to compare the cost-effectiveness between two different running models, OC and RC, for the SWL machine.

Methods

Between January 1999 and December 2005, OC for the SWL machine was implemented, and from January 2006 to October 2011, RC was applied. The SWL machine was electro-hydraulic (Lithotron, High Medical Techonologies, Switzerland) for both OC and RC. The machine was provided and maintained by the cooperation company, and a technician was also provided. The hospital provided medical staff, including physicians, nurses and administration staff, and a place for the SWL machine. With OC, the hospital paid the cooperation company 60% of the payment from BNHI for each treatment session. With RC, the rent for the lithotripter was a fixed payment/month and was contracted based on previous experience of self support and OC. In our study, the rent was 60% of the payment from BNHI for each treatment session multiplied by 27.5 (previous break-even point of OC).

The perceived cost for each treatment session was the sum of the lithotripter associated cost, consumptive materials and the salary of the medical staff. The formula for the perceived cost consisted of two parts, i.e., the variable cost and the fixed cost. With OC, the variable cost included 60% of the payment from BNHI for each treatment session and the cost of direct labor and direct materials, while the fixed cost included the cost of indirect labor and indirect materials. With RC, the variable cost included the cost of direct labor and direct materials, while the fixed cost included the rent/month divided by the treatment number/month and the cost of indirect labor and indirect materials.

The cost of direct labor included the salary of the in-charge physician and the technician, attributed by working hour, and the cost of indirect labor consisted of the salary of other medical staff, multiplied by the ratio (revenue from SWL divided by total revenue in the hospital). The cost of direct materials included the cost of medications and consumptive materials associated with the SWL procedure. The cost of indirect materials consisted of electricity, water and others, multiplied by the ratio (revenue from SWL divided by total revenue in the hospital). The details of the formula are shown in Table 1. Sensitivity analysis was based on the change of payment from the BNHI (increase or decrease). Evaluation of profit or loss for the SWL machine was based on the break-even point, which was defined as the lowest number of SWL sessions to maintain a balance of the costs every month. The payment by the insurance was variable in a different time period. For the purpose of comparability in cost analysis, we calculated the payment for each treatment session at a different period as that in January, 1999.

Patients with a staghorn or partial staghorn stone, a renal stone size $>$2.5 cm or a ureteral stone $>$1.5 cm were excluded from receiving SWL. Effectiveness parameters, including the stone-free rate, the retreatment rate, the rate for additional procedures and the complication rate, were evaluated. The stone-free state was confirmed by